

Claims

[c1] What is claimed is:

1.A reciprocating fuel pump comprising:

a pump assembly including a drive section and a pump section;

a drive assembly disposed in the drive section, the drive assembly providing a reciprocating motion to a drive member;

said pump section having a pump chamber, an inlet for introducing a fluid into the pump chamber and an outlet for fluid to be expressed from the pump chamber;

a plunger assembly comprising a plunger having an upper head region contacting the drive member, a lower end and a longitudinally extending passageway therebetween; and

a valve stem movably located within the passageway and having a lower end including a poppet head, the plunger having an upper position where fluid can be introduced into the pump chamber through the inlet and a lower position where the fluid is forcefully pumped from the pump chamber through the outlet, the reciprocating motion of the drive member moving the plunger between said upper and lower positions, the plunger contacting

said poppet head of said valve stem as said plunger moves from said upper position toward said lower position to forcefully move said valve stem into the pump chamber to pump the fluid in the pump chamber outwardly through the outlet.

[c2] 2.The reciprocating fuel pump as defined in claim 1 wherein said poppet head is displaced away from said lower end of said plunger when said plunger is in said upper position to create a gap between the lower end of the plunger and the poppet head.

[c3] 3. The reciprocating fuel pump as defined in claim 2 wherein said movement of said plunger toward its lower position moves the lower end of said plunger with respect to said valve stem to close the gap to seal the passageway.

[c4] 4.The reciprocating fuel pump as defined in claim 3 wherein said poppet head is press fitted with a bore in the valve stem.

[c5] 5. The reciprocating fuel pump as defined in claim 1 wherein the plunger assembly further includes a pliable bumper affixed to said plunger and located beneath the enlarged upper head region.

[c6] 6. The reciprocating fuel pump as defined in claim 1

wherein the upper end of said valve stem includes a pliable nipple that forcefully abuts a component of the drive section when said plunger is in said upper position.

- [c7] 7.The reciprocating fuel pump as defined in claim 6 wherein said drive assembly includes at least one permanent magnet and said pliable nipple abuts against said at least one permanent magnet.
- [c8] 8.The reciprocating fuel pump as defined in claim 7 wherein said pliable nipple is comprised of a deformable plastic material and deforms by the abutting contact with the component to stabilize the plunger.
- [c9] 9.The reciprocating fuel pump as defined in claim 1 wherein the upper head region has an enlarged upper surface that interfits into a complementary configured lower surface of the drive member.
- [c10] 10.A reciprocating fuel pump comprising:
a pump assembly including a drive section and a pump section;
a drive assembly disposed in the drive section, the drive assembly including at least one permanent magnet and a coil assembly disposed within the magnetic field of the at least one permanent magnet, said coil assembly movable reciprocally axially along a central axis upon appli-

cation of alternating current power to the coil assembly; said coil assembly comprises a coil bobbin and a coil contained within the coil bobbin, and a drive member actuated by the reciprocating movement of the coil assembly;

said pump section comprising a pump chamber for containing a quantity of fluid and having an inlet and an outlet, and a plunger assembly to pump fluid from the pump chamber; and

said plunger assembly comprising a plunger having an upper head region contacting the drive member, a lower end and a longitudinally extending passageway therebetween, a valve stem movably located within the passageway, the valve stem having an upper end and a lower end including a poppet head, the plunger having an upper position where fluid can be introduced into the pump chamber through the inlet and a lower position where the fluid is forcefully pumped from the pump chamber through the outlet, the reciprocating motion of the drive member moving the plunger between said upper and lower positions, the plunger contacting said poppet head of said valve seat as said plunger moves from said upper position toward said lower position to forcefully move said valve stem into the pump chamber to pump the fluid in the pump chamber outwardly through the outlet.

- [c11] 11.The reciprocating fuel pump as defined in claim 9 wherein said upper head region is an enlarged area having a surface that interfits with the contour of the drive member.
- [c12] 12.The reciprocating fuel pump as defined in claim 9 wherein the poppet head is displaced away from said lower end of said plunger when said plunger is in said upper position to create a gap between the lower end of the plunger and the poppet head.
- [c13] 13.The reciprocating fuel pump as defined in claim 11 wherein said movement of said plunger toward its lower position moves the lower end of said plunger with respect to said valve stem to close the gap to seal the passageway.
- [c14] 14.The reciprocating fuel pump as defined in claim 9 wherein the upper end of said valve stem includes a pliable nipple that forcefully abuts against the at least one permanent magnet when said plunger is in said upper position.
- [c15] 15.The reciprocating fuel pump as defined in claim 13 wherein the pliable nipple deforms by the abutting with the at least one permanent magnet to stabilize the valve stem within the plunger.

[c16] 16.A method of pumping a fluid from a reciprocating pump comprising:
providing a pump assembly having a drive section and a pump section having a pump chamber containing fluid and having an inlet and an outlet, the drive section producing a reciprocating motion upon activation by an electrical signal;
providing a pump assembly within the pump section, the pump assembly including plunger assembly including a plunger and a valve stem movable located within the plunger, the valve stem having a lower poppet head;
transmitting the reciprocating motion of the drive section to the plunger to move the plunger between an upper position where fluid can enter the pump chamber through the inlet and a lower position where the plunger forces fluid from the pump chamber through the outlet;
and
activating the electrical signal to drive the plunger into contact with the poppet head to move both the plunger and the valve stem into the pump chamber to move the plunger to its lower position.

[c17] 17.The method of claim 15 wherein the step of providing a pump assembly comprises providing a pump assembly having a gap between the lower end of the plunger and the poppet head of the valve stem.

- [c18] 18.The method of claim 16 wherein the step of 16 wherein the step of activating the electrical signal comprises activating the electrical signal to move the plunger the distance of the gap before contacting the poppet head as the plunger moves to its lower position.
- [c19] 19.The method of claim 17 wherein the step of providing pumping section comprises providing a valve stem having an upper pliable nipple formed thereon that abuts against a fixed component of the pump assembly when the plunger is in its upper position to stabilize the valve stem.
- [c20] 20.The method of claim 17 wherein the step of providing a valve stem comprises providing a valve stem having a plastic composition with the poppet head force fitted within a bore formed in the valve stem.